REMARKS

Review and reconsideration of the Office Action dated January 26, 2005, is respectfully requested in view of the above amendments and the following remarks.

Claim 14 was amended to include the limitation that the cured adhesive is a reaction adhesive. Support for the claim amendment can be found on page 4, paragraph [0006].

New Claim 34 has been added. Support for new Claim 34 can be found in Claim 14 as originally filed.

The specification and claims have been amended to fix a translation error. During the translation, the term "hardened adhesive" was used instead of the correct term "cured adhesive".

Applicants believe that the present set of claims is novel and non-obvious over the cited references.

No new matter has been added to the claims or the specification.

Applicants believe that all claims are in condition for allowance.

Compared with present Claim 14 the reference fails to teach: 1)the sub-floor is covered with a **cured adhesive**; 2) the adhesive has a **shear strength less than 1.2 N/mm^2**; 3) **the shear strength of the adhesive is less than the shear strength of the sub-floor; and 4)** the cured adhesive is **a reaction adhesive**.

Nowhere in the cited references can be found any indication that they recognize the importance of choosing a specific adhesive that has: 1) shear strength of less than 1.2 N/mm^2 and 2) shear strength less than the shear strength of the sub-floor.

According to the Examiner, it would have been obvious to one having ordinary skill in the art at the time of the invention to have the specific parameters for the adhesive material, since it has been held that discovering an optimum value of a parameter involves routine skills in the art.

Applicants note that the Van Bears reference (main cited reference) is not teaching any improvement over the prior art: a layer is glued to the sub-floor. The present invention was specifically developed to solve the problem faced by the prior art: wood expands when absorbing moisture and shrinks when (re)drying.

The wood conventionally contains 9% water during the laying process. The moisture content can change due to water uptake in new construction through the sub-floor, or from the environment, or as a result of the variable humidity depending upon the season. The expansion and shrinking caused thereby must be absorbed or accepted by the adhesive material. Thereby, substantial shear forces result. These shear forces can, in certain cases, result in a bowing out of the wood or result in gaps or formation of splits.

The present inventors realized that forces occurring during the expansion and shrinking of the wood elements can only be transmitted to the sub-floor without an impermissible localized accumulation of forces when they are distributed and evenly diffused, within the adhesive layer, over the entire adhesive surface.

After extensive research, the present inventors discovered that a hardened adhesive meets the following two criteria:

1) having a shear strength **of less than 1.2 N/mm^2 and**

2) **having a shear strength that is less than the shear strength** of the sub-floor **will prevent forces or tension peaks, which can lead to a release or break in the adhesive connection that deform the floor. (See Figure 2)**

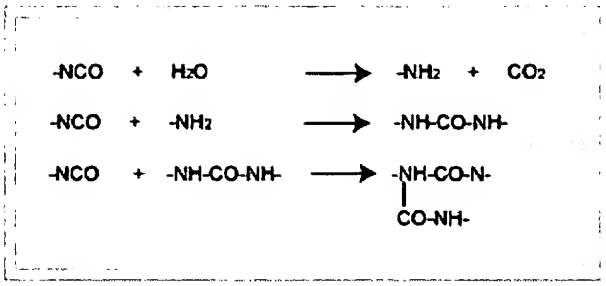
Regarding Claims 16-18

Regarding Claim 16, Applicants note that these claims require that the cured adhesive be a resin that is cured upon exposure to water.

Applicants would like to explain to the Examiner the chemical reaction that takes place during the curing of the water reactive adhesive. To explain the reaction, Applicant is refereeing specifically to polyurethane (Claim 17).

Moisture curing polyurethane adhesives (Claim 17) are actually based on isocyanate polymers. These are low molecular weight, linear polymer molecules, with isocyanate (-NCO) end groups.

The isocyanate end-groups react with any compound containing an active hydrogen, e.g., alcohols, amines, or other polyurethanes and ureas. The water vapor initiates the chemical reaction with the isocyanate groups as shown below. This results in increased molecular weight and crosslinking of the prepolymer into a strong, tough film.



The reaction involves a two-stage process. The water and the isocyanate groups first producing an amine and carbon dioxide. The amine then reacts with other isocyanate groups to form a urea until all available isocyanates are consumed. Carbon dioxide generated during the process leaves the film through diffusion and evaporation.

Because surface moisture completes the chemical reaction in moisture-cured polyurethane, these materials adhere well to visibly damp surfaces. They penetrate into pores and tight crevices where moisture is usually present to form strong chemical bonds. Since moisture is consumed in the process, the risk of blisters or a weak boundary layer caused by water trapped under the coating is greatly reduced.

Office Action

Turning to the Office Action, the paragraphing of the Examiner is adopted.

Claim Objections:

The Examiner has indicated that Claim 20 is objected to because of the following informalities: the Applicant is advised to remove parenthesis at "strain at break".

In response, Applicants have amended the claim by deleting the parenthesis including the limitation "strain at break".

Accordingly, withdrawal of the objection is respectfully requested.

Claim Objections:

The Examiner has also indicated that Claims 15-20 are objected to because of the following informalities: since the same floor is being claimed, the preamble of the dependent Claims 16-20 should be cited as "The floor" instead of "A floor".

In response, Applicants have amended the claims as suggested by the Examiner.

Accordingly, withdrawal of the objection is respectfully requested.

Claim Rejections (Formalities)

The Examiner has indicated that Claims 14-20 are rejected under 35 U.S.C 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The position of the Examiner can be found on page 2 of the Office Action.

In response, Applicants have amended the claims to **clearly indicate that the adhesive has:**

1) a shear strength in the hardened condition which is less than $1.2N/mm^2$; **and**

2) a shear strength in the hardened condition that is less that the shear strength of the sub floor. See attached proposed claim amendment.

Accordingly, withdrawal of the rejection is respectfully requested.

Claim Rejections (Obviousness):

The Examiner has rejected Claims 14, 15, 19 and 20 under 35 USC 103(a) as being obvious over Van Bers (US 5,564,251).

The position of the Examiner can be found on pages 2-3 of the Office Action.

Applicants respectfully traverse.

Applicants note that claims 15, 19, and 20 depend on Claim 14. The following remarks are addressed to the sole rejected independent claim, Claim 14, because if Claim 14 is not obvious, it follows that none of the other rejected dependent claims are obvious.

Compared with Claim 14 the reference fails to teach: 1)the sub-floor is covered with a **cured adhesive**; 2) the adhesive has **shear strength less than 1.2 N/mm^2**; 3) **the shear strength of the adhesive is less than the shear strength of the sub-floor; and 4)** the cured adhesive is **a reaction adhesive.**

Applicants would like to point out to the Examiner that the cured adhesive has to fulfill two conditions:

1) the **shear strength** is **less than 1.2 N/mm^2**;

2) **the shear strength has to be less than the shear strength of the sub-floor.**

First, Applicants note that the cited reference teaches a floor comprising a sub-floor, a layer of a resilient material covering the sub-floor and a wooden part. The layer of resilient material is **glued or adhered** to the sub-floor.

The reference teaches a double-sided adhesive strip which might be removed after the floor has been laid. In addition, the reference mentioned a layer of an elastic or resilient material which is not the adhesive layer.

Regarding point 1

Applicants note that the reference uses **glue or adhesive strips** to secure the resilient layer to the sub-floor. (Column 1, lines 43-55). Nowhere in the reference can be found the teaching of using a cured adhesive that it is a reaction adhesive.

Regarding points 2-3

First, Applicants note that the reference uses glue or an adhesive strip. Furthermore, Applicants note that Van Bers does not give any importance to the type of glue used in his invention.

Furthermore, Applicants note that the shear st**rength** of the different **types of adhesives are as follows:**

Adhesive Type	Shear Strength
	MPa

	(N/mm2)	
	Min	Max
Rubber	2	7
PVA (white glue)	1,4	6,9
Cyanoacrilate	6,9	13,8
Anaerobic	6,9	13,8
Polyurethene	6,9	17,2
Rubber modified acrylic	13,8	24,1
Epoxy	10,3	27,6
Polyimide	13,8	27,6
Rubber modified epoxy	20,7	41,4

As can been seen from the table, glue does not meet the criteria required by the present set of claims.

Nowhere in the reference can be found any indication that Van Bers recognizes the importance of choosing a specific adhesive that has: 1) a shear strength of less than 1.2 N/mm^2 and 2) a shear strength less than the shear strength of the sub-floor.

According to the Examiner, it would have been obvious to one having ordinary skill in the art at the time of the invention to have the specific parameters for the adhesive

material, since it has been held that discovering an optimum value of a parameter involves routine skill in the art.

Applicants note that the Van Bears reference is not teaching any improvement over the prior art: a layer is glued to the sub-floor. The present invention was specifically developed to solve the problem faced by the prior art: wood expands when absorbing moisture and shrinks when (re)drying.

The wood conventionally contains 9% water during the laying process. The moisture content can change due to water uptake in new construction through the sub-floor, or from the environment, or as a result of the variable humidity depending upon the season. The expansion and shrinking caused thereby must be absorbed or accepted by the adhesive material. Thereby, substantial shear forces result. These shear forces can, in certain cases, result in a bowing out of the wood or result in gaps or formation of splits. In the case of breakage it frequently occurs that not only the adhesive joint but rather also the sub-floor comprised of cement is damaged. This is due to the fact that the shear strength of the cement floor is relatively low in comparison to the wood adhesive. On the other hand, during the drying of the wood, pieces shrink. Since the wood adhesive does not permit a shrinking at the point of adhesion, frequently large gaps occur between the parquet pieces.

The present inventors realized that forces occurring during the expansion and shrinking of the wood elements can only be transmitted to the sub-floor without an impermissible localized accumulation of forces when they are distributed and evenly diffused, within the adhesive layer, over the entire adhesive surface.

After extensive research, the present inventors discovered that a hardened adhesive meets the following two criteria:

3) having a shear strength **of less than 1.2 N/mm^2 and**

4) **having a shear strength that is less than the shear strength** of the sub-floor **will prevent forces or tension peaks, which can lead to a release or break in the adhesive connection that deform the floor. (See Figure 2).**

Thereby it is achieved that, in the case of expansion or shrinking, the forces occurring at the adhesive layer are evenly distributed over the entire adhesive surface. There are no force or tension peaks, which can lead to a release or to a break in the adhesive connection. The distribution of the forces ensures that the floor covering elements deform less in the case of excessive moisture or in the case of drying out.

The covering elements are supported and held over large surface areas, without occurrence of breakage areas in the adhesive. Thereby, a bowing-out of the floor covering wood is avoided.

The surprising benefit of the inventive floor covering adhesion is comprised therein, that despite low shear strength of the employed adhesive, the avoidance of tension peaks makes it possible to achieve a substantially higher force transmission than with the convention rigid DIN adhesives.

Un-obviousness

In Ex parte Viscardi, 136 USPQ 382 the applicant discovered that addition of carbon dioxide will remove static electricity. The Examiner rejected the application over a reference which taught addition of carbon dioxide, but for a different reason. The court held that there is merit in the contention that a reference patent does, as urged by the Examiner, inherently provide carbon dioxide which will remove static electricity. **However, in the absence of appreciation by patentee (the reference) of the fact that carbon dioxide will remove static electricity, there is no reason why he, or one skilled in the art following his teaching, should inherently adjust the concentration of carbon dioxide for removal of complete static charge; hence, manipulative steps of applicant's claims do not inherently result from reference's disclosure.**

Thus, in the absence of appreciation by patentee Van Bers of the fact that choosing an adhesive having a shear strength **of less than 1.2 N/mm^2 and less than the shear strength** of the sub-floor will allow that in the case of expansion or shrinking, the forces occurring at the adhesive layer are evenly distributed over the entire adhesive surface; thus, preventing forces or tension peaks, which can lead to a release or break in the adhesive connection that deform the floor.

There is no reason why Van Bears, or one skilled in the art following his teaching, should inherently choose an adhesive based on the shear strength to prevent damage to the floor or sub-floor. In short, the manipulative steps of applicant's group of claims does not inherently result from the disclosure

of the basic reference.

Claims 15 and 19-20 are novel in view of their dependency with novel Claim 14.

Accordingly, withdrawal of the rejections is respectfully requested.

Claim Rejections (Obviousness)

The Examiner has rejected Claims 16-18 under 35 USC 103(a) as being obvious over Van Bers in view of Wood (US 5,721,302).

The position of the Examiner can be found on pages 3-4 of the Office Action.

Applicants respectfully traverse for the same reasons as set forth above and the following remarks.

Applicants note that Claim 16 depends on Claim 14; thus, all the previous arguments regarding the Van Bears reference are applicable to Claims 16.

Applicants note that compared with Claim 16, the Van Bears reference further fails to teach that the adhesive is comprised of a reaction-type resin which hardens upon exposure to water.

The Examiner cited the Wood reference to show that adhesive is comprised of a reaction-type resin which hardens upon exposure to water.

Applicants would like to point out to the Examiner that the Wood reference teaches high **shear strength** water based polyurethane latex adhesive. This adhesive is neither reactive nor does it have a low shear strength of less than 1.2 N/mm^2.

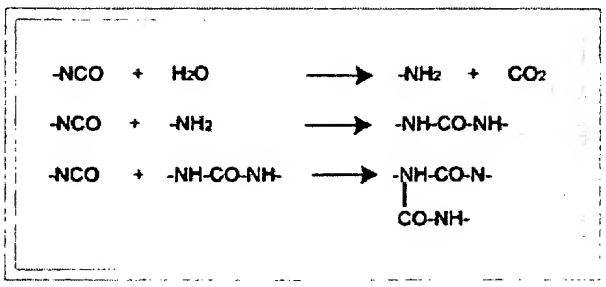
Furthermore, Applicants note that the water based adhesive mentioned in Wood does not harden upon exposure to water as required by Claim 16.

The present invention requires a cured **adhesive** having shear strength of less than 1.2 N/mm^2 (low shear strength). Thus, in the hypothetical case that the Van Bears floor is modified by using the adhesive according to Wood, the combination of references will not teach the limitation of present Claim 16 because the adhesive will not meet the criteria of the adhesive according to the claim.

Applicants would like to explain to the Examiner the chemical reaction that takes place during the curing of the water reactive adhesive. To explain the reaction, Applicant is refereeing specifically to polyurethane (Claim 17).

Moisture curing polyurethane adhesives (Claim 17) are actually based on isocyanate polymers. These are low molecular weight, linear polymer molecules, with isocyanate (-NCO) end groups.

The isocyanate end-groups react with any compound containing an active hydrogen, e.g., alcohols, amines, or other polyurethanes and ureas. The water vapor initiates the chemical reaction with the isocyanate groups as shown below. This results in increased molecular weight and crosslinking of the prepolymer into a strong, tough film.



The reaction involves a two-stage process. The water and the isocyanate groups first producing an amine and carbon dioxide. The amine then reacts with other isocyanate groups to form a urea until all available isocyanates are consumed. Carbon dioxide generated during the process leaves the film through diffusion and evaporation.

Because surface moisture completes the chemical reaction in moisture-cured polyurethane, these materials adhere well to visibly damp surfaces. They penetrate into pores and tight crevices where moisture is usually present to form strong chemical bonds. Since moisture is consumed in the process, the risk of blisters or a weak boundary layer caused by water trapped under the coating is greatly reduced.

Accordingly, withdrawal of the rejections is respectfully requested.

Claim Rejections (Obviousness):

The Examiner has rejected Claims 21-33 under 35 USC 103(a) as being obvious over Van Bers in view of Wood.

The position of the Examiner can be found on page 4 of the Office Action.

Applicants respectfully traverse for the same reasons as set forth in the previous paragraphs.

Accordingly, withdrawal of the rejections is respectfully requested.

Applicants believe that all the claims are now allowable.

Favorable consideration and early issuance of the Notice of

Allowance are respectfully requested. Should further issues remain prior to allowance, the Examiner is respectfully requested to contact the undersigned at the indicated telephone number.

Respectfully submitted,

Evelyn A. Defillo

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Tampa, FL 33634-7356

Evelyn A. Defillo
Registration No. 45,630

Date: **May 5, 2005**

CERTIFICATE OF MAILING AND AUTHORIZATION TO CHARGE

I hereby certify that a copy of the foregoing AMENDMENT A for U.S. Application No. 10/009,959 filed December 12, 2001, was deposited in first class U.S. mail, with sufficient postage, addressed to: **Mail Stop Amendment,** Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on May 5, 2005.

The Commissioner is hereby authorized to charge any additional fees which may be required at any time during the prosecution of this application without specific authorization, or credit any overpayment, to Deposit Account No. 16-0877.

Evelyn A. Defillo

Evelyn A. Defillo

MARKED UP VERSION OF

SPECIFICATION INDICATING

ADDITIONS AND DELETIONS

WOODEN FLOOR

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention concerns a wood floor, comprising a hardenable or ~~curable~~ cured adhesive which is coated as a continuous layer onto a floor base, and covering elements of wood or a wood material that are bonded to the adhesive over their entire surface to be glued.

Description of the Related Art

[0002] For adhering covering elements used to make parquet or inlay floors, adhesives are conventionally employed which are comprised of natural and/or synthetic resins and include suitable solvents and additives. According to applicable DIN (German Industrial Standard) 281, the parquet adhesives exhibit a shear strength of at least 3 to 3.5 N/mm^2, which results in a hard and brittle junction of the covering elements to the base floor. The adhesive is applied using a toothed trowel. When laying the parquet floor, attention must be paid to the fact that the parquet wood expands when absorbing moisture and shrinks when (re)drying. The parquet wood conventionally contains 9% water during the laying process. The moisture content can change due to water uptake in a new construction through the sub-floor, or from the environment, or as a result of the variable humidity depending upon the season. The expansion and shrinking caused thereby must be absorbed or accepted by the adhesive material. Thereby, substantial shear forces result. These shear forces can in certain cases result in a bowing out of the parquet wood or result in gaps or formation of splits. In the case of breakage it frequently occurs that not only the adhesive joint but rather also the sub-floor comprised of cement is damaged. This is due to the fact that the shear strength of the cement floor is relatively low in comparison to the parquet adhesive according to

DIN 281. On the other hand, during drying the parquet pieces shrink. Since the parquet adhesive does not permit a shrinking at the point of adhesion, frequently large gaps occur between the parquet pieces.

SUMMARY OF THE INVENTION

[0003] Beginning therewith, it is the task of the invention to develop a floor which can transmit the shear forces, resulting from expansion due to absorption of moisture and contraction due to drying back again, from the wood parquet elements to the sub-floor without separation of the adhesive bond and bowing out of the floor covering.

[0004] For the solution of this task, there is proposed a floor, comprised of a sub-floor continuously covered with a layer of hardened adhesive, and covering elements of wood or wood materials completely covered on their surface to be adhered with the adhesive, wherein the adhesive layer has a layer thickness of 0.5 to 5 mm, and wherein the adhesive has a shear strength in the ~~hardened~~ cured condition which is less than that of the sub-floor. Advantageous embodiments and further developments of the invention can be found in the dependent claims.

[0005] The inventive solution is based upon the idea, that the forces occurring during expansion and shrinking of the parquet elements can only be transmitted to the sub-floor without an impermissible localized accumulation of forces when they are distributed and evenly diffused, within the adhesive layer, over the entire adhesive surface. In order to achieve this, it is proposed in accordance with the invention that the adhesive layer has a thickness of 0.5 to 5 N/mm^2 and that the adhesive in the ~~hardened~~ cured condition exhibits a shear strength which is less than that of the sub-floor. The shear strength of cement floors is an

average of approximately 1.2 N/mm^2. In accordance therewith an adhesive is selected, of which the shear strength is less than 1.2 N/mm^2, preferably 0.6 to 1.0 N/mm^2. Preferably, a reaction adhesive is selected which hardens with a Shore Hardness (A) of 20 to 35. Thereby it is achieved that, in the case of expansion or shrinking, the forces occurring at the adhesive layer are evenly distributed over the entire adhesive surface. There are no force or tension peaks, which can lead to a release or to a break in the adhesive connection. The distribution of the forces ensures that the floor covering elements deform less in the case of excessive moisture or in the case of drying out. The covering elements are supported and held over large surface areas, without occurrence of breakage areas in the adhesive. Thereby, a bowing-out of the floor covering wood is avoided. On the other hand, in the case of drying out, the formation of gaps is reduced. Research has shown that the covering elements, in the case of absorbing excessive moisture, becomes somewhat compressed along their contact flanks. As a result of the pressing of wood, minor deformations occur within the wood in the edge area, which however are barely discernable from the outside. In the case of the inventive elastic adhesion, one obtains a substantially even surface loading or force distribution over the surface area. This means that the greater the adhered surface is, the greater is the force transmission or distribution. Besides this, a bonding is achieved in a way that protects the sub-floor. A substantially elastic joining also results in a substantial reduction in foot-step noise in comparison to the hard adhesives. The surprising benefit of the inventive floor covering adhesion is comprised therein, that despite low shear strength of the employed adhesive, the avoidance of tension peaks makes it possible to achieve a substantially higher force transmission than with the convention rigid DIN adhesives.

[0006] A preferred embodiment of the invention envisions that the adhesive is comprised of a reaction adhesive, preferably a polyurethane or polyurethane hybrid, which hardens upon exposure to water. Alternatively, the adhesive can be comprised of MS-polymers (modified silicones).

[0007] The invention is further concerned with the use of elastic adhesives with a higher breaking elongation, which hardens with a shear strength of less than 1.2 N/mm^2, preferably from 0.6 to 1.0 N/mm^2, for adhering wood floors onto a sub-floor preferably comprised of cement or concrete. The inventive adhesive is preferably applied to the sub-floor using a toothed trowel to a thickness of 0.5 to 5 N/mm^2.

BRIEF DESCRIPTION OF THE DRAWING

[0008] In the following the invention will be explained in greater detail on the basis of the illustrated embodiment represented schematically in the figures. There is shown:

Fig. 1 a section through a wood floor;

Fig. 2 a shearing stress - elongation diagram for DIN-parquet adhesives and an inventive adhesive.

DETAILED DESCRIPTION OF THE INVENTION

[0009] The parquet floor shown in sectional representation in Fig. 1 is comprised of an adhesive 12 applied in a continuous layer onto a sub-floor 10 comprised of cement, and covering elements 16 which are covered over their entire surface to be adhered 14 with the adhesive 12. The adhesive is preferably comprised of a one component polyurethane which hardens upon exposure to water, which in the ~~hardened~~ cured condition exhibits a

shearing strength τ of less than 1.2 N/mm^2. The shear strength τ is a quotient of the highest force F_{max} and the adhesive surface A of the floor-covering adhesive bond:

$$\tau = F_{max}/A$$

In the stress-elongation diagram according to Fig. 2, the stress-elongation curve $\sigma = f(\varepsilon)$ of various adhesives 1 and 2 is shown. The end of the respective curve defines the pull shear strength of the employed adhesive, which in the case of DIN-adhesive 1 is approximately 3.5 N/mm^2 and in the case of the inventive adhesive 2 is approximately 0.7 N/mm^2. As reference value there is shown with dashed line 3 in the diagram the average shear strength value of cement flooring. The inventive adhesive 2 belongs to the elastic adhesives while the floor covering adhesive 1 according to DIN 281 is non-elastic.

[00010] Experiments have shown that the elastic floor covering adhesive prevents bowing-out of the wood despite the lower shear strength of the adhesive, and this due to the even distribution of tension. The adhesion is shear resistant. Besides this, a material joining of the floor covering to the cement is produced: the shear strength of the proposed elastic adhesives 2 of 0.7 N/mm^2 is significantly lower than the surface rigidity of cement (1.2 N/mm^2). The hardness of the ~~hardened~~ cured adhesive 2 is approximately 20 to 30 Shore (A). Thus, no damage to the cement floor can occur. For this reason, a pre-coating for sealing or strengthening the cement surface is not necessary. In contrast, the rigid DIN-adhesives with their shear strength of 3.5 N/mm^2 are significantly above that of cement. When adhering therewith, tension peaks occur at the edges of the floor covering elements. The forces resulting from the movement of wood are not distributed over the surface. Even an enlargening of the

adhesive surface does not result in any improvement. In the case of the elastic adhesion, in comparison, the forces are transmitted or distributed over the entire adhesion surface: no tension peaks are produced. Thereby substantially higher forces can be transmitted with, at the same time, a lower tension exposure of the sub-floor. With the elastic adhesive no displacement occurs between the parquet elements. Besides this, a bowing out of the parquet elements is avoided.

Example

[00011] The general characteristics of the employed parquet adhesives are as follows:

Shore (A)	25-35	
Break Elongation	300 - 1000%	DIN 53 504
Shear Strength	< 1,2 N/mm^2	with reference to DIN 281
Recovery Value	> 70%	

[00012] In summary, the following can be concluded: The invention relates to a wooden floor, comprising of a ~~hardenable~~ cured adhesive 12 which is painted onto a floor base 10 in a continuous layer, and covering elements 16 of wood or a wood material of which the entire surface (14) to be bonded is adhered to the adhesive layer. According to the invention, the adhesive layer 12 has a thickness of 0.5 to 5 mm and the adhesive 12 has a shear strength, in its ~~hardened~~ cured state, which is les than that of the sub-floor 10 and is at most 1.2 N/mm^2, in order to obtain a floor covering with excellent dimensional stability.